FOREST RESEARCH DIGEST

DECEMBER 1935

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LAKE STATES FOREST EXPERIMENT STATION*

Forest Service U. S. Dept. Agr.

THE UPPER PENINSULA BRANCH STATION

The Experiment Station has from its very beginning been keenly interested in selective logging and the sustained yield management of northern hardwoods. The establishment of the Upper Peninsula Branch Station in 1926 created an opportunity to begin a series of long time experiments dealing especially with the biological aspects of selective logging rather than its economics which had already received considerable study by the Station and the Forest Products Laboratory. Through the cooperation of the Cleveland Cliffs Iron Company, the Experiment Station obtained control of the virgin timber on a half-section and full ownership of the land, together with an adjacent half-section of newly cut-over land. The tract is located twenty-two miles southeast of Marquette, Michigan, along highway M-28 which is one of the main arteries of travel through upper Michigan.

Starting in 1926 on a half-section of virgin timber, a number of different methods of cutting northern hardwoods have been tried out. These have ranged from a very light cutting in which only trees twenty-two inches or more in diameter were removed, to a complete clear cutting. Between these extremes numerous methods and degrees of cutting including the following were tried: group selection, twelve-inch diameter limit, 80% selection, heavy selection, over-mature and defective, and light selection.

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* Maintained in cooperation with the University of Minnesota at University Farm, St. Paul, Minnesota.

In addition to determining which of the different cutting methods is most desirable from the silvicultural standpoint, studies were also made of the cost of logging, products obtained, cull, reproduction, slash disposal, and mortality on the areas.

Five year re-measurements have now been completed on most of the areas. The results of these studies at Dukes are being used extensively in the formulation of a policy for purchasing virgin timber and for the management of similar types within the National Forests of the northern hardwood region.

On the cut-over half-section, thinnings and release cuttings together with supplementary planting are being tried on the second growth stands. Each year one or more type of treatment is made, and while insufficient time has elapsed for significant measurements of growth, considerable information has been obtained regarding effectiveness and costs of such treatment and relative speed with which the different tools can be used.

During the past summer, the station area was increased by purchase to about 5,000 acres, most of which is virgin hardwood and hardwood-conifer timber.

During the summer and fall, a two-hundred-man CCC camp was assigned to the tract to complete the physical development necessary for sustained yield management. As soon as the work is completed, logging will be started, putting into practice such information on management as has been assembled during the past nine years. The forest of the future will not only serve to answer questions of detailed silvicultural practice, but the units treated will be of sufficient size so that the economic and practical aspects of selective logging can be studied.

"What the Upper Peninsula Station Is and What It Does" has been described in a bulletin, a copy of which is enclosed with this issue of the Digest. The results of some of the cuttings have been described in a paper* by Eyre and Blythe.

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* "Mortality in Selectively Cut Northern Hardwoods," by F.H. Eyre and R. H. Blythe, Jr. Mimeographed publication of the Lake States Forest Experiment Station.

COMPRESSION WOOD IN BLACK SPRUCE

The Forest Products Laboratory has recently completed a preliminary study* of the effect of compression wood in black spruce on the properties of ground wood pulp. Compression wood is found on the underside of leaning trees and branches. It is quite different in appearance from normal wood, both macroscopically and microscopically; in freshly cut wood it can be identified by the eccentric growth rings, relatively high proportion of summer wood and a "lifeless" appearance due to lack of contrast between spring and summer wood.

At the Products Laboratory, pulping tests were conducted using several samples of wood, each having a different amount of compression wood. It was found that the pulp resulting from the grinding of the samples containing large amounts of compression wood was not well adapted to the manufacture of specialty products such as paper plates, although it gave little trouble when utilized for newsprint.

The cause of this seems to be that the pulp sticks with abundant compression wood produce a much larger proportion of fine fiber fragments than sticks free from compression wood.

This study brings up a silvicultural problem - the growing of black spruce which is as relatively free from compression wood as possible. Compression wood is formed in proportion to the degree of inclination of the trees; severely leaning trees produce much more compression wood than those only slightly inclined. Compression wood is most commonly found in the lower portion of the tree. Stands which develop under older stands seem to have more leaning trees than those which originate in open areas. Wind is another factor which is responsible for leaning trees. Silvicultural practices in the spruce type should be designed to hold to a minimum the number of leaning trees, for while leaning trees may produce a normal volume of pulpwood, its quality for certain uses is considerably reduced.

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* "Observations on Occurrence of Compression Wood in Black Spruce and Its Effect on Properties of Ground Wood Pulp", by M. Y. Pillow, E. R. Schaffer, and J. C. Pew, unpublished manuscript, Forest Products Laboratory.

EXTENT OF SHELTERBELT PROTECTION

Many estimates have been made of the distance to which the protection afforded by shelterbelts extends. There are very few actual measurements of the extent of such protection, and they vary widely. One case has been recorded in a Canadian publication* by Norman M. Ross, who quotes Dr. William Saunders, at that time Director of Dominion Experimental Farms. In this instance it was found that a shelterbelt of trees about fifteen feet high had afforded good protection to a field of barley for a distance of 50 times the height of the trees to the leeward of the windbreak. A very violent windstorm occurred and beyond the protection of the trees the barley had been wiped out by the wind which blew the plants out of the ground. Within 750 feet of the trees the crop was green and in good condition.

It should not be assumed from this that shelterbelt protection will always extend as far as 50 times the height of the trees, but this is at least one authoritative instance of such protection.

THE DENBIGH SEED SCARIFIER

The seeds of certain plants do not germinate freely and regularly because the living part of the seed is surrounded by a thick and relatively impervious seed coat. The seed coats of such species must be greatly thinned or removed entirely if the plants are to be raised on a large scale in the nursery. In order to do this economically it is necessary to put the seeds through a mechanical scarification process. Agriculturists have developed several types of machines which perform the task satisfactorily for the seeds of certain field crops, but these have not been entirely satisfactory when used to scarify tree seeds of certain species having especially heavy seed coats.

The Denbigh scarifer was developed by the Seed Laboratory and Northern Plains Branch of the Lake States Forest Experiment Station. It is a wooden drum 3 feet high and 2 feet wide,

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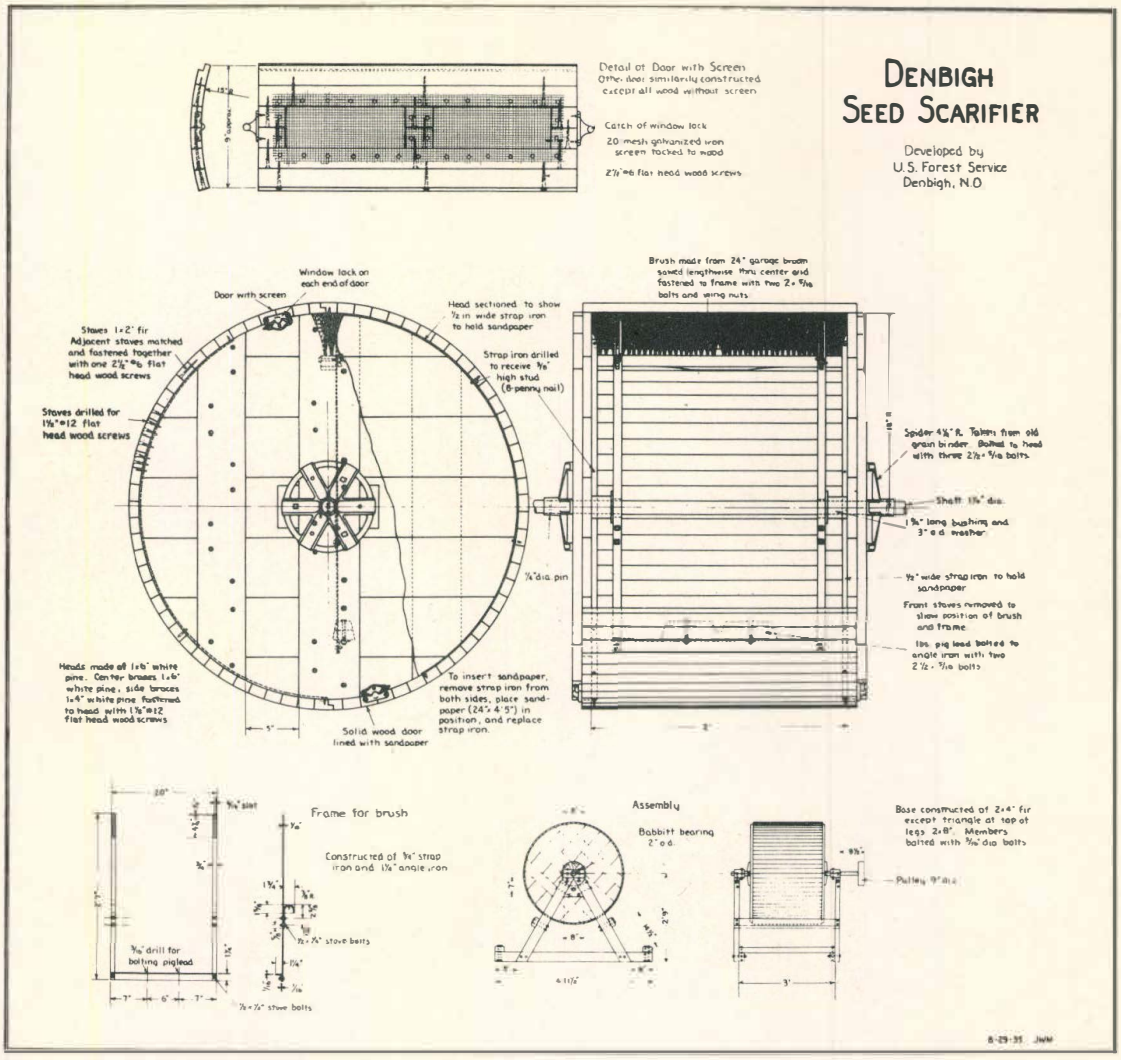
*"Tree Planting on the Prairies of Manitoba, Saskatchewan and Alberta", by Norman M. Ross, Department of the Interior, Canada, Forest Service Bulletin No. 1, 8th Editio n.



lined with No. 2½ grade 30 E silicon carbide sandpaper. The latter can be obtained in 50-yard rolls in a maximum width of 2 feet. Most efficient scarification is obtained when the drum revolves at 20 to 30 r. p. m. Motive power is furnished by a one-fourth horsepower motor and a set of pulleys and belts to reduce the speed to the proper point. About 20 to 30 pounds of seed can be scarified in one "run". Juniper can be scarified adequately in 2 to 4 days. Time of scarification will vary depending on the kind of seed and the thickness of the seed coat. The scarifier was designed particularly for seed of the genus *Juniperus*, some species of which have especially thick seed coats and have erratic germination unless scarified.

This scarifier is patterned after one developed by the Bessey Nursery, U. S. Forest Service, Halsey, Nebraska.

NATURAL REPRODUCTION IN THE BIRCH LAKE PLANTATION

The Norway pine plantation at Birch Lake on the Superior National Forest has already begun to bear seed. LeBarron and Sauer found seedlings of last year's origin in October, 1935. This plantation is only 23 years old from seed, and of course this reproduction will be of no value silviculturally but it is interesting to note at what a tender age these trees have begun to bear seed.

Cones were first noticed on the trees about three years ago but last year was the first time any seedlings were found. There are no old Norway pines growing in the vicinity so it is certain that the plantation trees are responsible for the seedlings.

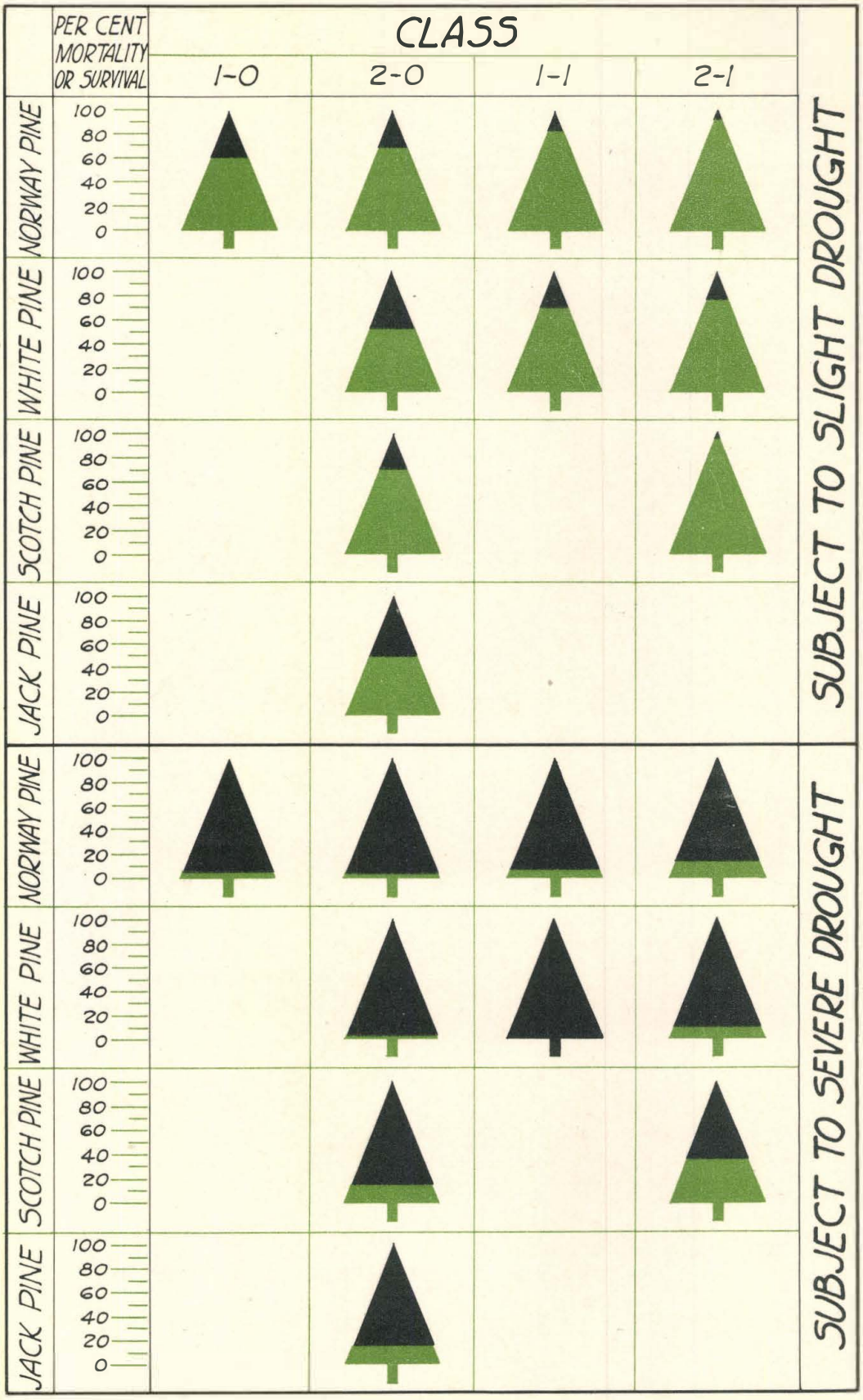
WHAT IS THE SIGNIFICANCE OF CLASS OF STOCK?

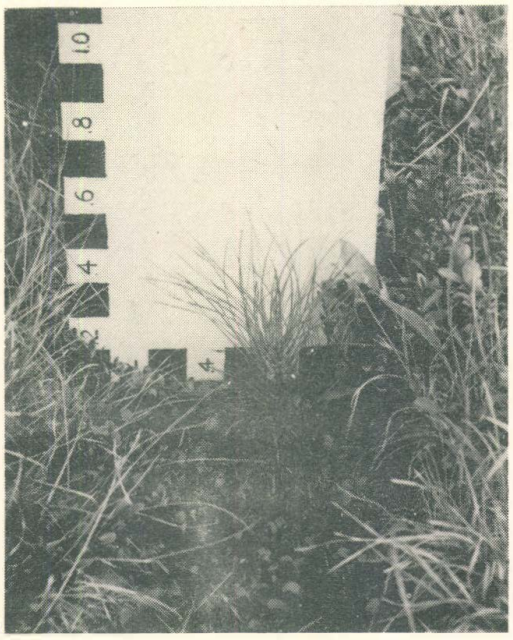
The cost of producing transplant stock is much greater than for seedling stock. There has always been much honest difference of opinion as to the relative merits of the several most commonly used classes of planting stock and when a large planting program is called for, the nurseries are under such stress that the advocates of the younger classes of stock are more apt to get a sympathetic ear. But it is enlightening to study the results of experiments especially designed to bring out the differences between the several classes of stock.

Such an experiment has been conducted by Paul Rudolf of the Experiment Station with the cooperation of the Huron National Forest, and the results secured do much to clear up the question, at least with regard to the early stages of plantations under Huron National Forest conditions.

The story is presented graphically by the chart which shows survival percentages at the end of the second growing season (there was very little change during the third growing season). Results are given both for plantations subjected to moderate drought and for those subjected to severe drought conditions. The photographs show typical specimens of each class of Norway pine stock at the end of the third growing season and illustrate what survival figures alone cannot show-the comparative growth and thriftiness of each kind of stock.

COMPARISON OF PLANTING STOCK





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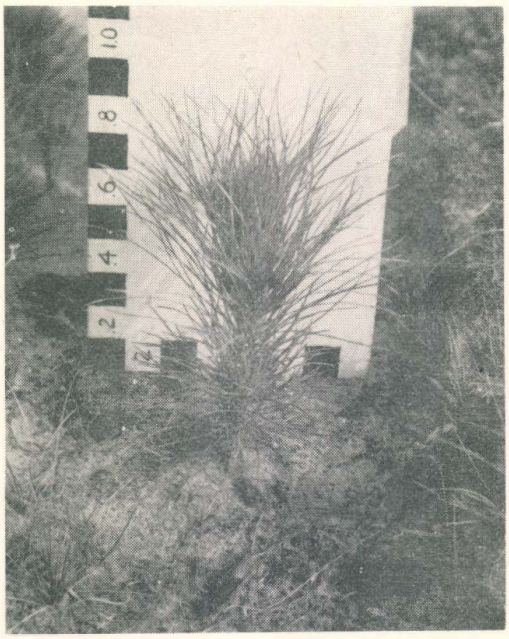

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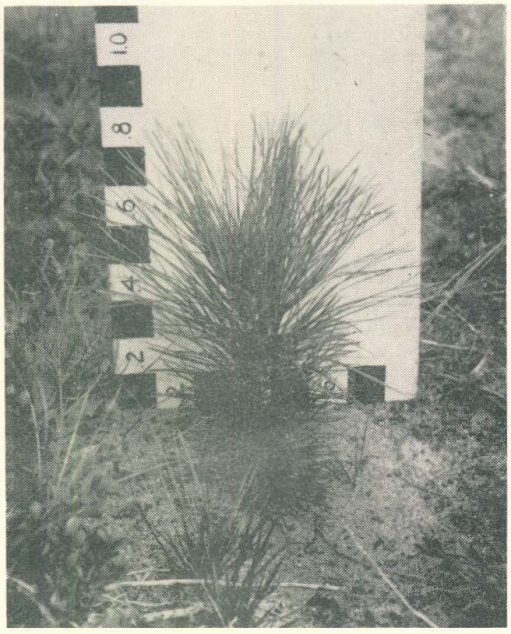

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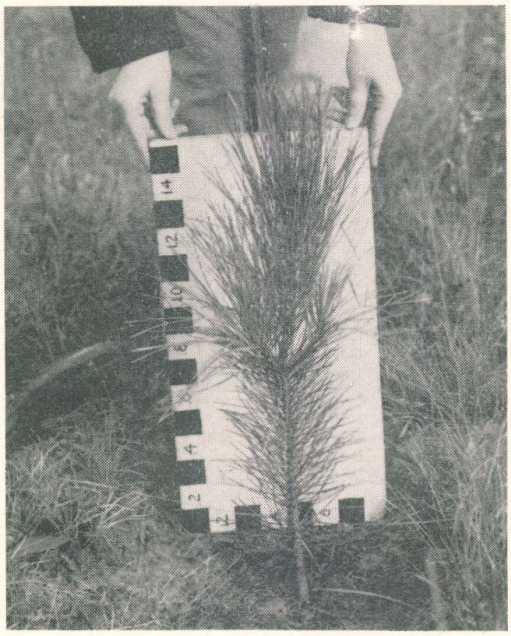

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Norway Pine

THERE'S PROFIT IN ASPEN

A recent cutting experiment in a mature aspen stand on the Pike Bay Experimental Forest afforded an opportunity to determine the profitableness of such operations. The primary product cut was bolts for box-boards. The stand was 45 years old and contained about 330 trees per acre, of which roughly 140 were 8 inches and over in diameter.

The following five different cutting methods were used: clear-cutting, 8 inch diameter limit, 9 inch diameter limit, 10 inch diameter limit, and selective cutting. Accurate time records of all the work were kept. Part of the work was done by ERA labor and part by CCC, but for simplicity in presentation all costs are presented on the basis of what the work would have cost had it been done entirely by ERA labor. The figures in the following table were worked out on this basis.

ASPEN CUTTING EXPENDITURES AND RETURNS PER ACRE

Type of Cutting	Cutting Cost *1.*	Piling Cost *2.*	Total Cost	Bolts Bd. Ft.	Fuelwood Cords	Total Income *3.*	Profit or Loss
Clear-cut	$52.61	$22.23	$74.84	5700	38	$64.60	-$10.24
8" dbh limit	$31.50	$13.30	$44.80	5800	18	$55.40	+$10.60
9" dbh limit	$21.15	$ 9.90	$31.05	5500	11	$49.50	+$18.45
10"dbh limit	$13.20	$ 7.23	$20.43	3800	7	$33.90	+$13.47
Select-ive	$17.10	$11.30	$28.40	1900	22	$26.20	-$ 2.20

1. Includes felling, bucking, swamping, and slash disposal (lop and scatter).

2. Carrying and piling of all material(maximum distance 3½ chains).

3. Bolts have a value of $8.00 per M. and fuelwood $.50 per cord.

All the plots except the clear-cutting and the selective cutting showed a net return over the cost of the operation. The three diameter limit cuttings would even show a small profit if

minimum Forest Service stumpage charges were deducted from the profits.

The clear cutting failed to show a profit because of the large amount of fuelwood which it produced. The selective cutting was really an improvement cutting and likewise yielded a heavy proportion of fuelwood because most of the best trees were left to grow.

Thus it is apparent that cutting in the much despised aspen type can be done at a good profit where suitable markets are available.

RABBIT OR DEER DAMAGE?

Both rabbits and deer are capable of doing considerable damage to forest plantations as well as natural stands of coniferous reproduction in localities where the populations of either of these animals are abundant, and at times when other natural food sources are scarce. To the inexperienced observer it is often difficult to distinguish between the nipping of these two animals. However, a close study of the nature of the nippings made by the deer and rabbit shows them to be markedly different. The rabbits, being equipped with sharp chisel-like incisors on both the upper and lower jaws, make a clean well defined cut across the stem or twig. The lower jaw is the main cutting tool and in making the cut it glides in an oblique, upward movement severing the twig usually in one bite, although occasionally two or more trials are needed to complete the job. The cut is made therefore, sharply and at an angle of approximately 45 degrees. (Figure 1)

Deer on the other hand have incisors only on the lower jaw and these do not have a keen cutting edge. Therefore, they tend to crush off the plant stem between the lower incisors and the tough elastic gum of the upper jaw. At the time of nipping the deer grips the stem in the jaws and with an upward jerk together with the bite breaks off the woody stem in a rough irregular squeeze off. (Figure 2) As a rule, deer browse higher from the ground than do the rabbits, although with the aid of a snowdrift rabbits can cut the side branches off at a height of six feet or more.

Two othe forms of damage are noted for deer and rabbits on forest trees Rabbits sometimes will bark or girdle the bark from the base of small trees up to three inches in diameter. The rabbits bite into the bark and tear it loose in an upward pull

Fig. 1. Twig nipped by rabbit (Enlarged)

Fig. 2. Twig chewed off by deer (Enlarged)

and then proceed to eat the bark as far as they can reach. On the very small plants they will sometimes eat into the woody tissues well beneath the cambium layer. Deer do some damage to trees by rubbing Preceeding the rutting season the bucks rub the velvet from their antlers by vigorously sliding the horns up and down the trunks of the trees and in so doing rub the bark off as well. This process usually occurs only on one side of the tree, and seldom causes its death.

SECOND SURVEY REPORT COMPLETED

The Forest Survey, now completed in Minnesota, describes forest conditions in four large districts in the State: (1) the Cloquet-Superior district, (2) the Central Pine district, (3) the Rainey River district, and (4) the Woodlot and Prairie district.

A report on the Cloquet-Superior district was issued by the Lake States Station in July of last year. The second report covering the Central Pine district has just been released.

The Central Pine district embraces the headwaters of the Mississippi River about Brainerd, Bemidji and Grand Rapids. It has a gross land area of 7,206,000 acres of which 5,284,900 acres or 73.3 percent are forested. It includes the Chippewa National Forest, Red Lake Indian Forest, Itasca State Park and a number of newer state forests.

In spite of excellent management of some of the public lands, the unit as a whole is in poor condition. One sixth of the forest land is deforested. Forty-six percent is occupied merely by aspen and scrub oak. Old growth sawtimber remains on only 1.26 percent of the land.

Lumber production is much less than formerly. Nevertheless, there are over 300 small sawmills, two pulpmills and 35 other wood-using plants in the district. Work is provided (part time at least) for around 2,000 men in the mills and 10,000 in the woods.

The demands of local industries and several outside of the district itself together with current fire and miscellaneous losses are depleting the pine sawtimber and spruce pulpwood much more rapidly than it is being replaced.

Permanent maintainance of existing industries is not possible under present disorganized management. On the other hand, reasonably good management of both public and private lands

would permit considerable expansion in the long run.

This is a naturally productive forest area, accessible, and capable of producing high class sawtimber and pulpwood. It deserves better care.

The measures recommended to improve conditions are comparatively simple, inexpensive, and can be accomplished with little additional legislation. They consist of:

1. Fire protection for entire area comparable to that now in effect on National Forests.
2. Program of extension among farmers and other land-owners to teach better management, cooperative marketing, etc.
3. Acquisition of key tracts of thrifty young growth and even mature timber in National Forests.
4. Consolidatiion of ownership in state forests by (a) purchases under the Fulmer Act, (b) exchanges with the federal government, (c) tax reversion.
5. A cutting plan for public timber which will supplement the cut from private lands and aim to maintain permanent industries in the district.

USES OF THE ABNEY LEVEL

A new edition of the "Abney Level Handbook"* has recently been printed. This bulletin is extremely useful in forestry work as it describes in detail many uses of the Abney level which are not usually thought of by foresters who have become accustomed to using the level only to measure tree heights and correct slope distances.

The adjustments of the various parts of the Abney are explained and several methods of making them are detailed. The use of the Abney in making topographic surveys by different systems is described. A very ingenious method of using the level for minor triangulations is illustrated.

The bulletin may be obtained from the Superintendent of Documents at a cost of five cents.

**The Abney Level Handbook* by H. A. Calkins and J. B. Yule, Forest Service, United States Department of Agriculture.